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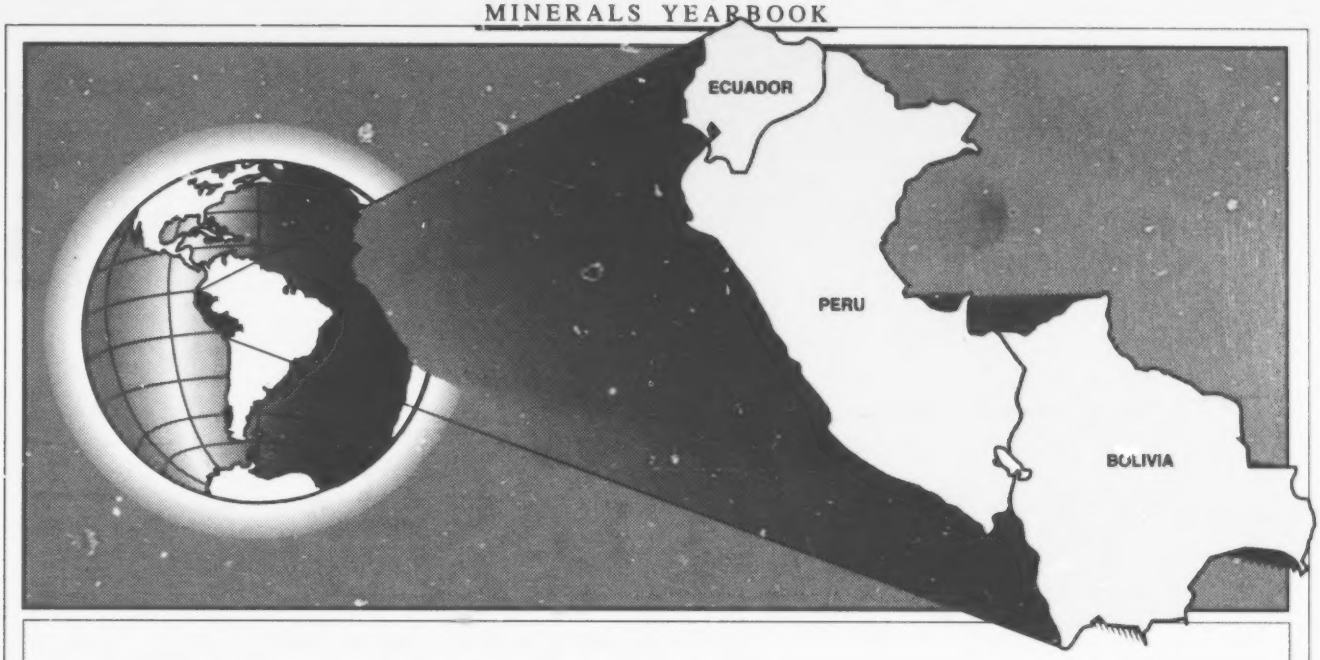

THE MINERAL INDUSTRIES OF

BOLIVIA, ECUADOR, AND PERU

By Ivette E. Torres, Alfredo C. Gurmendi, and Pablo Velasco

1988

INTERNATIONAL REVIEW

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

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BOLIVIA, ECUADOR, AND PERU

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1988

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INTRODUCTION[1]

All three countries in this Andean group have diversified mineral industries that play an important role in their respective domestic economies. Peru, as the largest country with a population of over 21 million, is the most diversified mineral producer with the highest value of total output. The values added by the mineral industries in 1988 were $2.78 billion for Peru, $1.98 billion for Ecuador, and $0.64 billion for Bolivia. Each value encompasses production of petroleum, natural gas, metals, and industrial minerals. During the period 1980–88, Ecuador's mineral output in terms of value expanded while that of Bolivia and Peru contracted.

The importance of the mineral industries in each country's economy is most evident in the export sector. In Bolivia, exports of all mineral commodities (oil, gas, metals, and industrial minerals) accounted for 82% of total exports; in Ecuador for 41%; and in Peru for 51% of the total. The percentages indicate the status of trade diversification in each country and the dependency on mineral exports as earners of foreign exchange to meet the burdensome foreign debt.

Crude oil and natural gas are produced in each country of the group, and Ecuador is the leading producer. Ecuador also has the largest proven reserves of oil in this group and was the only supplier of small amounts of crude oil and petroleum products to the U.S. market. Ecuador was the only country in which petroleum exports dominated the mineral sector. In Bolivia and Peru, nonfuel mineral exports were relatively more important—headed by copper, lead, and zinc exports in Peru and tin and zinc exports in Bolivia. Bolivia's main hydrocarbon export was natural gas to Argentina. Because of decreasing oil output, Peru was a net importer of petroleum in 1988 for the first time in recent years. Only Peru produced very small quantities of coal.

In terms of the world mineral economy, Peru is significant for its output of copper, lead, silver, tellurium, and zinc, and Bolivia for antimony, tungsten, and tin. Within Latin America, Peru ranks with Mexico as major world producers of silver. The level of oil output by the group is modest by world standards. All three countries produced modest amounts of gold.

Bolivia and Ecuador were involved with efforts to restructure their mining industries, including revision of the respective mining codes. In the near term, Bolivia evidenced the best prospects for expanded local and foreign investments in the mining sector because of political stability, improved investment climate, and access to mineral potential surveys in process or being planned.

Bolivia, Ecuador, and Peru were signatories of the Cartagena Agreement that became effective in 1969 forming a part of the "Grupo Andino" within the Latin American Integration Association (LAIA). The Latin American Energy Association (OLADE) is headquartered in Quito, Ecuador. Within Latin America, Ecuador is listed with Venezuela as members of the Organization of Oil Exporting Countries (OPEC). Peru is a member of the Intergovernmental Council of Copper Exporting Countries (CIPEC).

BOLIVIA[2]

Introduction

In 1988, Bolivia's nonfuel mineral production continued to be one of the most important sources of foreign exchange. The mining industry began to recover slightly after several years of reduced world prices and output and the collapse of the International Tin Council in 1985. The value of nonfuel minerals exports increased 32% from that of 1987, surpassing hydrocarbons for the first time since 1982 as Bolivia's leading foreign exchange earner. Tin, traditionally the country's most important mineral commodity, continued to be the focus of the industry. Low but stable world tin prices, improved economic conditions, and increased mineral production were responsible for the recovery of the tin sector.[3]

Mineral production continued to be shared between the Government and private industry. However, the mineral industry was in transition after a couple of years of Government restructuring and closeouts. The Government mining corporation, Corporación Minera de Bolivia (COMIBOL), formerly the largest mineral producer in the country, continued to evaluate and rehabilitate a large portion of its properties. Because of Supreme Decree 21377 of 1986, which decentralized COMIBOL in an effort to increase efficiency, production from this sector, the large-sized mining sector, continued to be very small in comparison with past production.

In contrast, production from the private mining sector composed of medium-sized mines and small-sized mines and cooperatives remained at traditional levels. As a result of the reduced COMIBOL output, the private sector increased in relative importance in terms of output distribution and general contribution to the economy.

Bolivia's economy improved for the second consecutive year after 5 years of deterioration. The gross domestic product (GDP) increased 2.8% in real terms from that of 1987. The largest growth in the economy was registered by the mining industry. Also, significant growth was experienced by the hydrocarbons, manufacturing, and construction sectors. The rate of inflation was about 22%. This rate was twice the planned level, but it was low compared with that of most of the neighboring countries. Because of recent changes in Government policies, economic stability after years of hyperinflation, and efforts to restructure and rehabilitate the mining industry, interest in Bolivia from foreign investors was increasing.[4]

Exports of nonfuel minerals and natural gas continued to generate a large percentage of the country's foreign exchange, together contributing to 82% of the cost, insurance, and freight value of exports. Although Bolivia achieved a trade surplus of $5.5 million,[5] it continued to be affected by a low level of investment, a high external debt, and health and education problems.

Government Policies and Programs

In an effort to increase investment in the mineral sector, the Government continued to release state-controlled areas with mineral potential for exploration by private domestic and foreign firms. Late in the year, the Government released a 43,290-square-kilometer zone in the northern part of the country, in the Provinces of Federico Román and Vaca Diez, Pando and Beni Departments, respectively. With this release, the Government has relinquished control of about 90% of its State land reserves. Other significant actions to increase exploration included the effort to liberalize the Mining Code, which was still under consideration by Congress at yearend, and to change the tax structure.

On September 14, the mining taxes established on August 29, 1985, were revised by the Permanent Committee of Actualization of Mining Royalties. The new royalty schedule is as follows:

The estimated marketing cost, expressed as a percentage of the official market price, remained unchanged in 1988. This artificial freeze of that element of the estimated cost resulted in a cost break to the mining industry.

The Minister of Mining and Metallurgy announced that a $29.5 million[6] loan for improvements in the mining industry was received from the Government of the Federal Republic of Germany. Portions of the loan were for the reconstruction of the Bolívar tin-zinc-silver mine in Oruro Department, fuel conversion for the COMIBOL Vinto smelter near Oruro, assistance to cooperatives in Potosí, and maintenance of the Karachipampa smelter unit.

Bolivia also received a $114 million loan for the mining sector from the International Bank for Reconstruction and Development (World Bank). Most of the World Bank loan was allocated for COMIBOL, the private mining sector, and the Servicio Geológico de Bolivia.

Production

Bolivia's production of most nonfuel minerals increased from that of 1987. Mine output of tin, Bolivia's most important nonfuel mineral, increased by 30% to more than 10,500 tons but remained far below historic levels. Tin smelter production also increased sharply, but it too was below past levels. Production of zinc, the second most important nonfuel mineral in terms of export value, increased 31% to almost 57,000 tons. Production of gold and silver, also very significant nonfuel mineral commodities, increased 77% and 63%, respectively. Other nonfuel mineral commodities that registered output increases include bismuth, cadmium, cement, iron ore, and tungsten. However, production of antimony and sulfur decreased.

Employment by the mining sector was about 3% of Bolivia's workforce in 1988. COMIBOL continued to operate as a holding company with five autonomous subsidiary mining companies and two autonomous subsidiary smelting companies. Some of the mine properties controlled by COMIBOL have been leased to mining cooperatives.

The private mining sector in Bolivia consists of medium-sized mines and small-sized mines and cooperatives. In 1988, the Asociación Nacional de Mineros Medianos continued to be the representative body of 18 medium-sized mining companies. Estalsa Boliviana S.A. left the association after its alluvial tin operation at the Antequera River was closed in September because of serious damage to the dredge. On the other hand, the Empresa Minera Copromín Ltda., a tin-antimony producer in Oruro, joined the association in 1988. During the year, the association registered increased production in all of its mined minerals. The number of small mines operating in Bolivia increased from 600 in 1987 to 800 in 1988; this number was still a reduction compared with previous years. Mining cooperatives were involved in the production of antimony, gold, iron ore, salt, sulfur, tin, and tungsten.

Trade

Minerals and hydrocarbons continued to be Bolivia's leading exports, together contributing 82% of the total value of exports. Exports of nonfuel minerals increased in terms of volume and value. In fact, for the first time

Commodity	Quantity (metric tons)	Category A[1] (dollars)	Category B[2] (dollars)
Antimony[3]	20.0	$18.87	$19.98
Bismuth[4]	3.0	2.77	2.94
Copper[4]	10.0	.66	.71
Lead[4]	25.0	.06	.07
Silver[5]	.2	3.88	4.10
Tin[4]	4.0	2.44	2.58
Tungsten[3 6]	15.0	88.00	94.00
Zinc[4]	15.0	.088	.094

[1] For producers with production of more than the indicated tonnage.
[2] For producers with production of less than the indicated tonnage.
[3] Per long ton unit.
[4] Per metric ton of metallic fine content.
[5] Per troy ounce.
[6] WO_3 content.

Source: Gaceta Oficial, Sept. 1988.

TABLE 1

BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]	1984	1985	1986	1987[p]	1988[e]
METALS[3]					
Antimony:					
Mine output, Sb content	9,281	8,925	10,243	10,635	[4]9,943
Metal including Sb content of trioxide	861	762	1,171	1,723	362
Arsenic, mine output, arsenic trioxide, arsenic sulfide	144	361	241	132	[4]191
Beryllium: Beryl concentrate:					
Gross weight	—	—	—	42	[4]—
BeO content	—	—	—	3	—
Bismuth, mine output, Bi content	3	159	45	1	[4]13
Cadmium, mine output, Cd content[5]	124	104	36	15	[4]39
Copper, mine output, Cu content	1,610	1,665	338	9	[4]153
Gold, mine output, Au content[6] troy ounces	40,827	18,037	24,531	38,575	157,177
Iron ore:[7]					
Gross weight	[r]14,192	—	10,586	7,490	[4]33,840
Fe content	[r]8,941	—	6,669	4,718	21,319
Lead:					
Mine output, Pb content	7,448	6,242	3,121	9,043	[4]12,544
Metal including alloys	185	231	182	201	359
Silver, mine output, Ag content thousand troy ounces	4,560	3,580	3,058	4,565	7,451
Tin:					
Mine output, Sn content	19,911	[r]16,471	10,462	8,128	[4]10,573
Metal, smelter	15,842	12,859	7,673	2,667	5,461
Tungsten, mine output, W content	1,893	1,643	1,095	638	900
Zinc, mine output, Zn content	37,770	37,110	33,472	39,292	[4]56,957
INDUSTRIAL MINERALS					
Barite	984	1,282	129	1,337	—
Calcite	[e]150	23	300	600	600
Cement, hydraulic	285,600	379,500	295,175	396,018	[4]452,285
Gypsum, crude[e]	700	700	700	700	700
Salt[e]	10,000	10,000	10,000	10,000	10,000
Sulfur, native	1,878	2,741	4,730	8,746	[4]6,733
Ulexite	—	—	—	—	[4]586
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross million cubic feet	173,206	164,118	160,858	161,197	169,875
Marketable do.	[r]84,021	[r]85,246	86,319	84,556	88,983
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	601	593	540	514	544
Plant liquids do.	1,136	1,460	1,406	2,097	1,357

See footnotes at end of table.

TABLE 1—Continued

BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1984	1985	1986	1987[p]	1988[e]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude including condensate	thousand 42-gallon barrels	7,621	7,245	6,956	6,890	7,020
Refinery products:						
Liquefied petroleum gas	do.	1,712	1,788	542	473	1,859
Gasoline	do.	2,728	2,784	2,988	3,318	3,347
Jet fuel	do.	548	573	587	547	578
Kerosene	do.	653	578	358	360	325
Distillate fuel oil	do.	r2,223	r2,204	2,432	2,330	2,275
Residual fuel oil	do.	(7)	(7)	(7)	(7)	—
Lubricants	do.	74	67	107	107	107
Unspecified	do.	20	12	66	73	311
Refinery fuel and losses	do.	87	8	5	348	169
Total	**do.**	**8,045**	**7,834**	**7,085**	**7,556**	**8,971**

[e] Estimated. [p] Preliminary. [r] Revised.

[1] Table includes data available through Oct. 1989.

[2] In addition to the commodities listed, a variety of crude construction materials (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.

[3] Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.

[4] Reported figure.

[5] Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

[6] Small- and medium-size mines output sales to BAMIN and COMIBOL exports.

[7] Revised to zero.

since 1982, the nonfuel minerals sector surpassed the hydrocarbon sector as the leading foreign exchange earner. The total value of Bolivian nonfuel mineral exports increased by about 32% from that of 1987 to $273 i million; this represented 46% of total export value. Exports of refined tin and concentrate, historically Bolivia's most important mineral export, increased by 7% in volume and about 12% in value to almost $77 million. Most other metal exports increased in value also. The largest such increases were as follows: zinc, 83%; gold, 57%; and silver, 35%. According to preliminary data, gold was Bolivia's third most important nonfuel mineral export, after tin and zinc, contributing $59 million to export earnings. In contrast, exports of antimony decreased in volume and value.

In terms of value, the European Community was the leading importer of ore concentrates and metals from Bolivia. It was followed by the United States, the Latin American Integration Association, the European Free Trade Association, the Centrally Planned Economy Countries, the Andean market, Asia, and others.

For the first time, the private sector's contribution to the nonfuel minerals exports exceeded 40% of the total, reaching over 70%. The medium-sized mining sector accounted for about 41%, followed by the small-sized mining sector and mining cooperatives with 30%.

Argentina continued to be the sole importer of Bolivia's natural gas. Although exports of natural gas to Argentina increased in volume, they decreased in value. Total exports of hydrocarbons, mainly natural gas, decreased by $33 million in 1988 to $215 million.

Commodity Review

***Metals.*—Antimony.**—Bolivia was the world's second largest producer of antimony, after China. Mine production of antimony, all by the private sector, decreased by almost 7% from that of 1987, to about 10,000 tons. The medium-sized mining sector contributed to about 66% of the total production. Their production increased by almost 4%. The largest producer of antimony continued to be Empresa Minera Unificada S.A., with an output of 3,300 tons. Production from the small-sized mining sector decreased by about 21%.

In 1988, Bolivia exported 7,381 tons

TABLE 2

BOLIVIA: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1987	1988	Principal destinations, 1988
Antimony:			
Ore and concentrate	10,761	7,381	NA.
Trioxides	683	554	United Kingdom 521; Chile 33.
Metal including alloys:			
Regulus	652	124	West Germany 59; Peru 58; Chile 7.
All forms	388	337	United Kingdom 318; Chile 19.
Arsenic: Trioxides and other compounds	132	191	NA.
Barite and witherite	1,337	—	
Beryllium: Ore and concentrate	42	—	
Bismuth: Ore and concentrate	—	11	NA.
Boron materials: Crude natural borates	—	586	NA.
Cadmium: Ore and concentrate	—	4	NA.
Copper: Ore and concentrate	7	111	NA.
Gold:			
Ore and concentrate, Au content troy ounces	39,429	60,236	NA.
Metal including alloys, unwrought and partly wrought do.	44,040	76,516	NA.
Iron and steel: Iron ore and concentrate	7	9	NA.
Lead:			
Ore and concentrate	7,436	9,871	NA.
Metal including alloys	8	24	Panama 11; Ecuador 8; Chile 5.
Silver:			
Ore and concentrate thousand troy ounces	4,884	6,852	NA.
Metal including alloys, unwrought and partly wrought do.	—	114	United States 99; France 15.
Sodalite	—	4	NA.
Sodium compounds, n.e.s.: Carbonate, natural	20	—	
Stone, sand and gravel: Dimension stone:			
Crude and partly worked	—	187	NA.
Sulfur, all forms	8,746	6,733	NA.
Tin:			
Ore and concentrate	8,255	4,734	NA.
Metal including alloys, all forms	2,096	6,297	Chile 2,397; United States 2,145; Colombia 367.
Tungsten: Ore and concentrate	1,220	1,033	NA.
Zinc: Ore and concentrate	39,639	53,969	NA.

NA Not available.

[1] Table prepared by H. D. Willis. Table includes partial provisional export data. Import data for 1985–88 were not available at time of publication.

of antimony. As in 1987, the Vinto antimony smelter remained closed. Vinto did, however, export a very small amount of metallic antimony from its limited stocks to the Federal Republic of Germany and Chile. The Empresa Minera Hermanos Bernal S.A. Palala Smelter in Tupiza, Potosí Department, produced 662 tons of antimony in antimony trioxide. The Bernal exports of antimony trioxide and alloys went to the United Kingdom and Chile.

Gold.—Official gold production, based on gold sold to the Banco Minero de Bolivia (BAMIN), increased by 77% to more than 157,000 troy ounces. This rise has been attributed to actual production increases as well as to more gold that had been exported legitimately as a result of the new decree that permits the BAMIN to pay 5% above the London gold price for domestic gold.

Cooperatives operating in the gold fields of Guanay, Huayti, Mapiri, Teoponte, and Tipuani and the small-sized mines continued to be the main sources of gold production. This sector contributed about 78% of the total official output. The remainder (22%) was produced by the medium-sized mining sector. Inti Raymi S.A., the largest gold producer in Bolivia, contributed most of the production from the medium-sized mining sector. The only other producer from this sector, San Juan Ltda., produced less than 1% of the total.

A 1-year, $15 million option to purchase 33% of Inti Raymi, a joint venture between Westworld of Texas and EMUSA, was acquired by Battle Mountain Gold Co. of Houston, Texas. During the option period, which began on October 1, Battle Mountain planned to invest $1.5 million in exploration and reserve evaluation. In 1988, EMUSA and Westworld announced that the Inti Raymi operation would increase its production by 25% in 1989.

Silver and Zinc.—In 1988, Golden Star Resources Ltd., of Canada, purchased the Empresa Minera Reminsa S.A.'s outstanding shares in 1988 for an undisclosed amount. Reminsa's Carquaicollo mine has proven ore reserves of 70,200 tons, with an average grade of 6.5% zinc, 5 troy ounces of silver per ton, 0.5% antimony, and 0.5% lead. Golden Star also reached an agreement to develop and operate the Candelaria Mine in Potosí. Outlined proven and probable reserves total 419,000 tons with significant values of silver and gold and lesser values of antimony, lead, and zinc.

Tin.—Tin continued to be Bolivia's most important nonfuel mineral commodity. Its production increased 30% from that of 1987 to about 10,600 tons. The largest production increase in the private sector was by small-sized mines and cooperatives, which in 1987 replaced COMIBOL as the leading tin-producing sector, and in 1988, accounted for about 60% of Bolivia's tin production. The COMIBOL production, only about 15% of the total, increased from 384 tons to 1,594 tons. Tin production from the medium-sized mining sector increased about 14% to 2,610 tons.

COMIBOL continued to work under the restructuring program established by Supreme Decree 21377 of August 1986. At that time, COMIBOL had closed its Huanuni tin mine; the mine was reopened in September 1988 with a 52% reduction in the workforce. With COMIBOL's Catavi-Siglo XX Mine (operated by Empresa Minera Catavi) being closed, Huanuni became the world's largest tin mine in operation and Bolivia's richest tin mine. The Huanuni Santa Helena mill was rehabilitated to process 1,000 tons of ore per day. Ore content was 1.7% tin and was expected to increase to a grade of 2% tin. Reportedly, initial concentrate output was planned at 200 tons per month of 50% tin to be increased to 500 to 600 tons per month later in the year. Rehabilitation investment for the mine and mill by 1988 was estimated at $3 million. As a result of the $1 million loan by Vinto for the rehabilitation of the mill, COMIBOL and Vinto agreed that Vinto would receive about 50% of the Huanuni tin concentrate for smelting. Tin production from Huanuni, which became the COMIBOL leading tin producer in 1988, was 806.2 tons.

The COMIBOL Colquiri tin-zinc mine, originally scheduled to be leased to mining cooperatives, remained closed, owing to rehabilitation of the 1,000-ton-per-day concentrator. COMIBOL planned to reopen the mine in mid-1989.

In September 1987, the miners' union, Federación Sindical do Trabajadores Mineros Bolivianos (FSTMB), proposed a plan to COMIBOL for the reactivation and rehabilitation of Empresa Minera Catavi. The plan focused on the selective recovery of high-grade tin waste dumps generated by the Victoria mill and the Siglo XX flotation plant by open pit methods to be treated at the Victoria mill to produce tin concentrate. The 3-year reactivation project was designed to utilize the existing equipment and technology. The rehabilitation part of the program, which would involve the extraction of tin from the rest of the dumps, would require more advanced technology. COMIBOL rejected the proposal in February 1988. Reportedly, the FSTMB objective was for COMIBOL to retain Catavi under its control instead of transferring it to the cooperatives.

According to reports, after a year of crisis in 1987, Vinto slightly exceeded its planned production in 1988. The smelter produced 5,373 tons of tin metal. Production for 1989 was projected at 8,000 tons. In addition, after securing a loan from the Government of the Federal Republic of Germany, Vinto was planning to upgrade its existing technology, convert its energy source from oil to natural gas, improve emissions control, and update its equipment.

In 1988, Vinto also obtained new equipment from China to replace its smelting method from electrolysis,

which is one of the reasons why the Bolivia refining costs are the highest in the world, to continuous crystallization. Reportedly, with this new method scheduled to be in place in 1989, Vinto will save about $800,000 per year.

Bolivia's measured and indicated tin reserves at yearend 1988 were estimated at 420,000 tons and were distributed as follows: COMIBOL, 130,000 tons (underground); medium-sized mining sector, 230,000 tons; and small-sized mining sector, 60,000.

Tungsten.—Production of tungsten in concentrate increased 41% from the depressed level of 1987. However, both value and volume of concentrate exports decreased. International Mining Co. (IMCO) continued to be Bolivia's largest producer of tungsten concentrate, contributing 39% of the national total from its Chojlla Mine. The IMCO Chambillaya and Enramada Mines, closed in 1986, remained closed. Production by the medium-sized mining sector was 54% of the total. The remainder was produced by the small-sized mining sector. COMIBOL ceased production from its Kami and Bolsa Negra mines in 1986. In 1988, the COMIBOL mines were being operated by cooperatives.

At yearend, Bolivia's measured and indicated tungsten reserves, in concentrate (wolframite content) at yearend 1988 were as follows: COMIBOL, 8,000 tons; medium-sized mining sector, 55,000 tons; and small-sized mining sector, 10,000 tons.

***Industrial Minerals.*—Cement.**—Production of cement increased 14% from that of 1987 to 452,285 tons. Domestic sales in 1988 totaled 444,105 tons. Most of the cement production capacity was under Government control and owned and managed by regional development corporations.

In April, the El Puente cement plant began production in the Méndez Province, Department of Tarija. The plant, completed in 1984, is one of four operating in Bolivia. Of the four plants, only one, property of Sociedad Boliviana de Cementos S.A. (SOBOCE), is privately owned. With El Puente coming on-stream, cement production capacity in Bolivia was increased to 700,000 tons per year. The 60,000-ton-per-year, $19 million plant is the smallest plant in the country. It was designed and constructed by the United States-French consortium GATX-Fuller S.A. and CGEE Alsthon. The plant operates with clinker imported from Argentina. Initial production from El Puente in 1988 was only 2,150 tons.

The other two Government-owned plants, Compañía Boliviana de Cementos S.A.M., in Irpa-Irpa, Department of Cochabamba, and Fábrica Nacional de Cementos S.A., at Cal Orko, Department of Chuquisaca, have production capacities of 100,000 tons per year and 330,000 tons per year, respectively. The SOBOCE plant in Viacha, Department of La Paz, has a capacity of 210,000 tons per year.

Lithium.—Industria Minera Tierra Ltda., a Bolivian company, and two U.S. companies expressed interest in developing the Salar de Uyuni, the world largest salt flat. Early in the year, Industria Minera Tierra requested permission from the Government to establish a pilot plant to begin producing 40 tons of lithium carbonate per year, but with plans to eventually expand production to 240 tons per year. However, the Government showed interest in joint-venture arrangements by announcing plans to call for international bids.

Reportedly, at yearend the Government of Bolivia and Lithium Corp. of America (LITHCO), a U.S. company, were negotiating a joint-venture operation in the Salar de Uyuni. The LITHCO plans included an exploration program and, possibly, a 7,000-ton-per-year plant. The brines would be evaporated in solar ponds.

Preliminary studies of the Salar de Uyuni, which is over 3,600 meters above sea level, indicated that the brines contain reserves of 5.5 million tons of lithium, 110 million tons of potassium, and 3.2 million tons of boron.

Mineral Fuels.—Bolivia's production of hydrocarbons continued to be negligible, and reserves were modest by world standards. However, this sector of the mineral industry continued to play a major role in Bolivia's economy. Hydrocarbons were Bolivia's second largest foreign exchange, contributing 36% of the total value of exports. Levies on exports and domestic sales of hydrocarbons accounted for about 55% of National Treasury revenues. The contribution of hydrocarbons to the gross national product was 6.5%.

Bolivia's hydrocarbon industry continued to be controlled by the Government. The State-owned Yacimientos Petroliferos Fiscales Bolivianos (YPFB), the industry operating unit under the Ministerio de Energía e Hidrocarburos, has total control of exploration, production, refining, transportation, and retail sales. Although YPFB is not authorized to participate in joint ventures, the law allows for operational-service contracts with private companies. In 1988, only two contractors, Occidental Boliviana Inc. (a subsidiary of Occidental Petroleum Corp.) and Tesoro Bolivia Petroleum Co. (owned by Tesoro Petroleum Corp. and Mobil Corp.), remained active in Bolivia.[7]

In May, YPFB signed an agreement with Occidental Boliviana and Tesoro Bolivia regarding contractor payment for natural gas exported to Argentina and crude and condensate sold to YPFB. The agreement, formalized by the Government in August, provided for payments of past due receivables and future invoices for oil and gas to be met through sales of Argentine goods and services obtained under credit arrangements. Also, an investment account was created for funds to be reinvested by the two contractors in exploration and development in Bolivia.

YPFB signed two exploration con-

tracts with Occidental Boliviana in August. Contract XXII, covering 2.6 million hectares, targets the reservoirs in Carboniferous and Denovian formations in the Lapacho Block. Under the contract, YPFB and Occidental Boliviana would each receive 50% of the production from this area. Contract XXIII was for the exploration of 2.5 hectares in the Madre de Dios Block. Production-sharing for this block would vary based on production rates.

Only YPFB performed field exploration activity in 1988. YPFB ran 1,432 kilometers of exploration seismic lines, a 22% decrease from that of 1987 and drilled 21,787 meters in eight exploratory wells. Occidental Boliviana drilled 4,160 meters in the Bordo Alto structure in the Chaco Block. Of the exploratory wells drilled in 1988, only the Sirari X-2 in Bolivia's Central District was a discovery well.

Natural Gas.—Production of natural gas increased 5.4% from that of 1987. Almost 68% of the total production was produced by YPFB and the remainder was produced by Occidental Boliviana and Tesoro Bolivia. Of Bolivia's natural gas production, 6% was for domestic consumption, 36% was re-injected in the reservoir, and 46% was exported. Argentina continued to receive 100% of Bolivia's natural gas exports.

In August 1988, the Presidents of Bolivia and Brazil signed an agreement by which Bolivia will supply natural gas to Brazil. Negotiations between the two countries began with a 20-year sales agreement in 1974. A 1978 letter of intent revised the sales volume upward, but this volume was reduced in 1982. In 1983, YPFB and Brazil's Petróleo Brasileiro S.A. (PETROBRÁS) formed a joint economic and technical committee to draft the sales contract between the two countries. The resulting 25-year agreement signed in 1988 was to become effective in 1992.

The agreement included the construction of a pipeline from Santa Cruz to Corumbá in Brazil at the border with Bolivia. Brazil was to purchase between 105 and 110 million cubic feet of natural gas per day; this gas would be used by a 500-megawatt plant to be constructed to generate electrical energy for the Matto Grosso State. Other projects to be implemented under the agreement include the construction of a 200,000-ton fertilizer plant at the Bolivian-Brazilian border, construction of a 100,000-ton polymers plant, exports of liquefied petroleum gas to Brazil totaling 12 million cubic feet per day, and construction of a 30-megawatt hydroelectrical plant to provide energy to the Brazilian States of Acre and Rondonia.

According to YPFB, quantified and certified natural gas reserves at yearend were estimated at 5.5 trillion cubic feet.

Petroleum.—Production of crude oil and condensate increased slightly from that of 1987. Of the approximately 7 million barrels produced, the YPFB share was 82%. Domestic consumption of refined products increased slightly. The value of domestic sales increased by almost one-third, because of increases in the local price of petroleum products. In 1988, the price of petroleum products was increased by the Government 10 times. The only liquids exported by Bolivia were wet gas to Argentina and 175,026 barrels of diesel oil bartered for gasoline with PETROBRÁS.

Estimates by YPFB indicate that crude oil and condensate reserves at yearend totaled 182 million barrels.

ECUADOR[8]

Introduction

Ecuador is planning to develop an important and viable mining industry, and the Government is prepared to attract investors to explore and develop mines and prospects throughout the country. Ecuador and the Overseas Private Investment Corp. of the United States signed an accord to provide investors with guaranties against political uncertainties.

The GDP increased about 9.7% to $10.2 billion,[9] an increase of $0.9 billion from 1987. The oil and mining industries grew by 86% compared with the depressed output level of 1987. The non-oil sector grew slowly by 1.5%. The manufacturing sector growth of 0.7% continued to be stagnant, and construction declined 6.8%. The unemployment rate averaged 7.2%.

Ecuador's foreign debt amounted to $9.6 billion. Significant commercial bank lending was not available, and disbursements from multilateral banks virtually ceased after July, because of the arrearage that accumulated by yearend to $1.0 billion.

Government Policies and Programs

In August, the Government announced its intention of maintaining an open-door policy with respect to foreign investments. Ecuador's mining industry continued to be marginal; however, Government policies, such as the current mining code, promote growth to complement the oil industry and improve the economy, which was affected by high inflation, unemployment, and debt burden.

The Instituto Ecuatoriano de Minería (INEMIN), the official mining regulating agency, is also in charge of exploration and development of minerals, precious metals, and industrial minerals in Ecuador. INEMIN also is involved in the exploration of polymetallic ore deposits, assisted by Japan and the Government of Belgium.

Production

The major mineral commodities produced and exported by Ecuador were cement, gold, limestone, liquefied natural gas, and crude oil and related derivatives.

The total value and volume of Ecuadorian mineral production increased in 1988 compared with that of 1987. Value of output, including metals, industrial

TABLE 3

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

Country and Commodity		1984	1985	1986	1987[p]	1988[e]
ECUADOR[2]						
Cadmium, mine output, Cd content[e]	kilograms	300	300	300	300	300
Cement, hydraulic	thousand metric tons	1,874	1,742	3,866	[3]1,601	2,000
Clays:						
Common Clay	metric tons	92,750	133,749	26,472	[3]29,200	30,000
Kaolin	do.	2,484	2,981	2,000	[e]2000	2,000
Copper, mine output, Cu content	do.	180	100	100	[e]100	100
Feldspar	do.	2,084	3,389	2,298	[3]1,558	3,000
Gas, natural:						
Gross	million cubic feet	18,111	21,495	[e]22,000	[e]12,300	NA
Marketable	do.	4,769	4,583	5,140	3,233	NA
Gold, mine output, Au content	troy ounces	280,000	300,000	317,327	[3]305,432	305,000
Gypsum (for cement)	metric tons	213,941	316,468	290,680	[3]255,289	262,000
Feldspar	do.	2,084	3,389	2,298	1,558	1,600
Iron and steel:						
Steel, crude	do.	18,143	17,874	17,084	[3]25,200	[3]23,500
Semimanufactures	do.	138,611	133,182	181,850	[3]172,400	[3]173,600
Lead concentrate, Pb content	do.	200	200	200	[e]200	200
Natural gas, liquids:						
Natural gasoline	thousand 42-gallon barrels	[r]186	229	232	186	200
Liquefied petroleum gas	do.	[r]499	591	789	278	300
Total	**do.**	**[r]687**	**820**	**1,021**	**464**	**500**
Petroleum:						
Crude	do.	[r]94,721	[r]100,631	106,580	63,510	[3]111,630
Refinery products:						
Gasoline	do.	[r]7,844	[r]7,642	8,788	6,904	6,900
Jet fuel	do.	1,045	[r]1,117	1,170	1,288	1,200
Kerosene	do.	2,279	[r]2,179	2,187	1,581	1,600
Distillate fuel oil	do.	10,077	13,646	6,281	6,371	6,400
Residual fuel oil	do.	[r]13,959	[r]12,583	13,667	11,769	11,000
Lubricants	do.	283	291	287	294	300
Liquefied petroleum gas	do.	[r]1,098	[r]1,293	1,635	770	800
Unspecified	do.	575	718	730	620	600
Refinery fuel and losses	do.	514	1,089	840	[e]812	800
Total	**do.**	**[r]37,674**	**[r]40,558**	**[r]35,585**	**30,409**	**29,600**
Silica	metric tons	21,437	22,441	36,649	[3]14,675	15,000
Silver, mine output, Ag content[e]	troy ounces	2,400	2,000	2,000	2,000	2,000
Stone, sand and gravel:						
Limestone (for cement manufacture)	thousand metric tons	3,135	3,762	6,500	[3]2,773	3,000
Marble	metric tons	6,679	11,435	15,195	[3]15,210	15,000

See footnotes at end of table.

TABLE 3—Continued

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

Country and Commodity		1984	1985	1986	1987[p]	1988[e]
Sulfur[e]						
Native	metric tons	5,000	4,000	4,000	4,500	4,500
Byproduct:						
From petroleum	do.	5,000	5,000	5,000	5,000	5,000
From natural gas	do.	5,000	5,000	5,000	5,000	5,000
Total	**do.**	**15,000**	**14,000**	**14,000**	**14,500**	**14,500**
Zinc, mine output, Zn content	do.	100	100	[e]100	[e]100	100

[e]Estimated [p]Preliminary [r]Revised NA Not available

[1]Includes data available through mid-June 1989.

[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand gravel, and stone) undoubtedly were also produced, but output was not reported, and available information was inadequate to make reliable estimates of output levels.

[3]Reported figure.

minerals, and mineral fuels and related derivatives was $1.1 billion in 1988 compared with $870 million in 1987. The mineral fuel and its derivatives sector accounted for more than $970 million of the overall value of mineral production. The metals sector, mostly gold, accounted for almost $100 million output, and the industrial minerals sector accounted for the remainder.

Trade

The value of total exports amounted to $2.2 billion and imports amounted to $2.0 billion. U.S. exports to Ecuador reached $680 million, an increase of 11% over that recorded in 1987. In 1988, the value of U.S. imports from Ecuador decreased to $1.2 billion, a decline of 8% relative to the previous year. Fifty-six percent of Ecuador's total exports were sold to the United States, and the United States supplied 31% of Ecuador's total imports.

Commodity Review

Metals.—**Gold.**—Portovelo Mine, in El Oro Province, is administered by INEMIN. The mine produced 15 to 20 tons per day of gold ore, and recovered about 1 kilogram of gold per month by conventional gravimetric methods. Proven and probable gold ore reserves at yearend were 120,000 tons containing 1% copper, 1.17% zinc, 63 grams of silver per ton, and 12 grams of gold per ton.

Most gold operations in Ecuador are concentrated in three important areas, known as Nambija, Portovelo, and Ponce Enríquez, where gold is mined by underground methods and recovered by gravimetry followed by amalgamation. Gold also was extracted from alluvial deposits and placers, where producers used wooden sluice boxes, small dredges, and washing plants. The three main areas are in the southern part of the country, and have been experiencing a "gold rush" since 1985. Gold production in 1988 of about 8,000 kilograms was sold to agencies of the Central Bank in the producing centers; however, it was thought that real production ranged from 8 to 9 tons per year, and that placer production was about 50 kilograms.

The Ecuadorian Government is encouraging joint ventures, mainly to install plants to treat gold ores in the three important operating centers.

Geevor del Ecuador Cooperativa Anónima (Geevor) has been active in Ecuador since the spring of 1988, developing business opportunities based on the recovery of gold from rich mill tailings and ore produced from local mines in the Portavelo area.

Minera La Trocha Cooperativa Anónima is 90% owned by Geevor del Ecuador C.A. Geevor was developing two projects in the southern part of Ecuador. About 16 kilometers north of Zaruma, in El Oro Province, Geevor was building an 80-ton-per-day grinding plant; north of Zaruma at Curva Grande, overlooking the Río Calera, Geevor was constructing a leaching plant at a capacity of 150 tons per day to recover gold and silver together with concentrates of copper and antimony.

Orolab Cooperativa Anónima (Orolab), a subsidiary of Geevor, was formed to establish laboratory and refining services in Quito. Orolab built a fully operational assay laboratory to serve company needs and the gold mining industry as well. Geevor also built a refinery to produce gold and silver bullion.

Minera Gowanda Sociedad Anónima, a U.S. company established in 1973, operated gold placer deposits in the Esmeralda area, northwest of Ecuador. Compañía Minera Ecuatoriana Sociedad Anónima (COMINECSA) is another Canadian firm that operated the Río Amarillo gold placer in El Oro Province.

Other Metals.—INEMIN's La Plata Mine, once privately operated, was closed. The massive sulphide deposit in Cotopaxi Province contained proven and probable ore reserves of 300,000

tons containing 4% copper, 2.3% zinc, 43 grams of silver per ton, and 2.5 grams of gold per ton. The Ecuadorian Government is planning to privatize it.

Minera Molleturo S.A. owns the Molleturo polymetallic ore deposit 113 kilometers southwest of Quito, Cotopaxi Province; this deposit is of the vein type containing lead, zinc, silver, and gold. After initial exploration and underground development, the company at yearend calculated reserves of 150,000 tons at 1.3% copper, 5.2% lead, 6.9% zinc, 18 grams of silver per ton, and 1.5 grams of gold per ton. However, the mine was on standby because of the lack of financing to continue exploration, development, and the construction of infrastructure.

The only active polymetallic mining project in Ecuador is at the San Bartolomé Mine owned by Armeño Resources Inc., a Canadian firm based in Vancouver, British Columbia. The property is 16 kilometers from Cuenca City. Since 1986, Armeño Resources was involved in underground exploration and development work at the Ocashuaico area. Ore reserves for the San Bortolomé Mine increased to 120,000 tons at 1.86% zinc, 0.57% lead, 560 grams of silver per ton, and 0.55 gram of gold per ton. The ore deposit has a potential of an additional 500,000 tons of ore with comparable contents. The company was planning to bring the mine into production and install a processing plant to treat 100 tons of ore per day by early 1989.

Industrial Minerals.—Nonmetallics also played a significant role in the mining sector of Ecuador. The major operations were in the cement industry, which has large quarries for limestones and clays. The Italian Government assisted the marble and ceramic industries to achieve much improved and competitively finished products to be sold in foreign markets. Other important industrial minerals were silica sands, pumice, kaolin, feldspar, and semiprecious gems.

Mineral Fuels.—**Petroleum.**—Ecuador's oil production was 110 million barrels, an increase of 73% over the previous year. Ecuador's oil exports increased by 65% to 69 million barrels; of the oil exported, 10.4 million barrels went to repay an "in-kind loan" from Venezuela, which was made after the earthquake of 1987. Domestic consumption increased by 3% to 37.1 million barrels. The main production of oil in Ecuador was a joint venture of the Ecuadorian State Petroleum Corp., La Corporación Estatal Petrolera Ecuatoriana (CEPE) (61.5%) and Texaco Inc. of the United States (38.5%). The Minister of Energy and Mines announced in September that CEPE would exercise contractual rights to take over operations managed by Texaco. The partnership will expire in July 1992.

Investments made by foreign firms in Ecuador for oil and gas exploration totaled $200 million. Results to date have been somewhat disappointing; however, CEPE found a large oil field in the Amazón area. Ecuador's oil reserves were estimated at 1.2 billion barrels. The major foreign oil companies involved in Ecuador since the mid-1980's were British Petroleum Ltd. of the United Kingdom and Conoco Inc. of the United States. These companies have so far successfully discovered oil saturated sands in the eastern part of the country. Production tests were being conducted to determine the precise volume of the oil reservoirs. Other foreign companies involved in offshore and inland oil explorations are Occidental Inc., Tenneco Inc., Exxon Corp., Arco Inc., and Conoco Inc. of the United States; Belco Corp. of Belgium; Braspetro S.A. of Brazil; Cogema S.A. and Elf-Aquitane S.A. of France; and Petrocanada Ltd. of Canada.

PERU[10]

Introduction

The mineral sector of Peru suffered another major setback in 1988 as a result of the lengthy work stoppages by the National Federation of Mine, Metallurgical, and Steelworkers Union, which paralyzed the mining industry for over 80 days. These events seriously affected the country's mining output. Mining companies continued to suffer from the country's severe shortage of foreign currency, which was urgently needed to import equipment and spare parts. This was the result of the Government's decision to maintain its policy of severe controls over the allocation of foreign currency to importers. The mining industry also had to cope during the year with poor prospects for foreign investment, isolation from the international financial community, and increasingly frequent terrorist attacks.

Production figures for most metals fell sharply, especially those for copper, lead, silver, and zinc, all of which were more than 20% below the previous year's figures. As a result, mineral producers were unable to benefit from improved world metal prices prevailing over the year. Expansion activities at Southern Peru Copper Corp. (SPCC), the state-owned companies, and the small- and medium-scale mining sector of the economy were limited.

The country's GDP, which had been growing steadily since the current administration took office, decreased by 8.5% to $16.0 billion[11] during 1988. The most affected sectors were mining (-17.6%), manufacturing (-14%), and construction (-5.4%). The only sectors of the economy that experienced relatively modest growth were agriculture and fishing. Accumulated inflation by yearend reached 1,722%, a rate never recorded in the country's recent history. In 1988, there was a $60 million negative trade balance, and for the third consecutive year Peru failed to have a $1 billion surplus. The value of the total Peruvian exports increased by 1.2% during 1988 reaching $2.69 billion, while imports value dropped by 13.6% to $2.75 billion. The country's total foreign debt reached $16.5 billion in 1988.

Government Policies and Programs

One of the main, if not the most important, impediments in the performance of the mining sector in 1988 was the Government's problematical exchange rate policy. According to the Peruvian National Mining Society, the multiple exchange rate policy cost mineral exporters approximately $1.1 billion between July 1985 and December 1988.

The continuous fall in purchasing power of mine workers, as a result of the hyperinflation noted above, became a highly politicized issue for the National Federation of Mine, Metallurgical, and Steelworkers Union, which insisted on a nationwide collective bargaining agreement for the mining sector. Miners were getting an exchange rate closer to parity, and the right to convert up to 30% of the value of their exports for import certificates. Although this was a move in the right direction, mining sector leaders considered the changes insufficient and were publicly demanding that the Government implement a single rate of exchange. This would allow mining companies to import foreign equipment, spare parts, and supplies at the same exchange rate applicable to their exports.

The Finance Ministry published regulations in early December designed to encourage foreign investors to swap discounted debt paper for new export-oriented ventures in Peru. But the scheme was not expected to materialize in the foreseeable future. Under the new regulations, creditors or investors who have picked up Peruvian foreign debt on the secondary market would be invited to exchange it for Intis, local currency, to spend in Peru on new export-oriented projects. The Central Bank will buy the debt paper at a discount set in quarterly auctions. A maximum value, somewhere above the paper's value on the secondary market, will be set by the Government according to how soon the project will earn foreign exchange income and on its value to the country in dollars.

Debt-for-equity swaps have been tried in a few Latin American countries. In Chile, the scheme's showcase, the medium- and long-term debt has been reduced by $5.2 billion in 3 years. Peru's rules differ from Chile's in two important respects, however. With foreign debt arrears at $6.5 billion and climbing, the focus of the regulations is on attracting foreign risk capital in dollar-earning ventures rather than simply reducing the debt. One proposal being discussed at yearend emphasized the need for an immediate inflow of dollars to the country. Under this proposal, the debt was to be paid in Intis at face value rather than at a discount, and the investor was to pay a fee in dollars based on the amount of the debt. The other variation on the Chilean scheme is that investors will not be able to buy into assets that are already producing. Additionally, investors will be obligated to spend up to the dollar equivalent of one-third of the project cost on imports.

The scheme has met with little interest in Peruvian and foreign financial circles. One criticism is that it would require new Government spending at a time when public funds are not covering basic imports and wages. Furthermore, foreign investors are unlikely to be attracted to exporting from Peru when Government policies, since 1985, have discriminated consistently against exporters.

Production

According to preliminary statistics released by the Ministry of Energy and Mines, the country's mining industry contracted significantly in 1988. Decreases in mine production of Peru's five most important metals, including copper (−27%), lead (−27%), silver (−24%), zinc (−21%), and iron ore (−16.5%), were registered. Smaller production losses were registered in other metals such as cadmium (−20%), tin (−17%), and molybdenum (−27%). Increases were registered in tungsten (+110%) and gold (+2.1%). All the production decreases were the result of serious labor unrest, financial disincentives resulting from an overvalued exchange rate, lack of foreign currency to finance improvements, and frequent terrorist attacks against mining installations. Mining companies with limited output were unable to benefit from higher metal prices during the year. However, despite this significant drop in mineral production, export earnings declined only 8.2% during the year. Summarizing the production activity of Peru's main mineral commodities, the main copper producers were SPCC (65%), with two large mines (Cuajone and Toquepala), Empresa Minera Especial Tintaya S.A. (11.4%), Empresa Minera del Perú S.A. (Minero Perú) (8.6%), and Empresa Minera del Centro del Perú S.A. (Centromín) (7.4%), with six mines (Casapalca, Cobriza, Mahr Tunnel, Morococha, Yauricoha, and Andaychagua). The remainder (7.6%) was represented by 35 mines (Pativilca, Condestable, and Raura were the main ones). The main lead producer was Centromín (42.7%) with six mines. The remainder (57.3%) was represented by 43 mines, of which Milpo, Atacocha, and Santa Luisa were the main ones.

The main silver producers were Centromín (21.7%) with seven mines (Casapalca, Cerro de Pasco, Cobriza, Mahr Tunnel, Morococha, Yauricocha, Andaychagua), and SPCC (4.2%) with two mines (Cuajone and Toquepala). The remainder (74.1%) were represented by 47 mines, of which Orcopampa, Santa Luisa, Atacocha, and El Brocal were the main ones.

Iron ore production declined 16.5% in 1988; the state-owned Hierro Perú was the sole iron ore producer. Tin production from the country's sole producer, Minsur S.A. decreased by 17% relative to 1988 output. Total crude oil output decreased 13.4% in response to lower demand. Natural gas production was approximately at the same level of 1987.

Trade

Despite a decrease in volume, the sharp increase in metals and fish meal prices pushed the value of Peruvian

TABLE 4

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1984	1985	1986	1987[p]	1988[e]
METALS						
Antimony:						
Mine output, Sb content		672	594	[e]670	[e]590	420
Metal		372	377	356	318	[2]246
Arsenic, white[3]		1,090	1,257	1,273	1,221	[2]828
Bismuth:						
Mine output, Bi content		650	785	605	438	386
Metal		[r]504	738	569	412	[2]363
Cadmium:						
Mine output, Cd content		674	579	463	461	[2]368
Metal		390	420	387	351	[2]303
Chromium, mine output, Cr content		—	—	—	461	[2]368
Copper:						
Mine output, Cu content		353,927	391,332	397,364	406,430	[2]298,332
Sulfate (Cu content)		2,535	2,539	2,234	2,073	[2]1,268
Metal:						
Smelter		298,806	326,592	286,167	234,924	[2]192,621
Refined		188,571	226,787	225,614	224,808	[2]179,455
Electrowon		31,450	27,434	27,533	24,461	[2]19,915
Gold:						
Mine output, Au content	troy ounces	187,406	212,870	284,373	263,186	[2]268,683
Metal	do.	79,734	84,653	84,074	64,977	[2]76,904
Indium	kilograms	2,903	3,863	3,333	3,877	[2]2,120
Iron ore and concentrate:						
Iron and steel:						
Gross weight	thousand tons	3,979	4,892	5,036	5,019	[2]4,189
Fe content	do.	2,663	3,290	3,356	3,305	[2]2,794
Metal:						
Pig iron[4]	do.	4	163	216	192	[2]202
Ferroalloys		—	—	739	2,362	2,000
Steel ingots and castings	thousand tons	337	397	487	503	[2]496
Semimanufactures	do.	346	304	377	396	[2]392
Lead:						
Mine output, Pb content		193,652	201,460	194,378	203,950	[2]149,037
Metal		70,192	81,895	66,417	71,333	[2]53,601
Manganese, mine output, Mn content		273	334	119	[e]200	146
Molybdenum, mine output, Mo content		2,974	3,807	3,484	3,353	[2]2,444
Selenium metal, refined	kilograms	20,758	14,506	12,035	11,430	[2]4,937
Silver:						
Mine output, Ag content	thousand troy ounces	53,080	58,230	61,916	66,052	[2]49,885
Metal, refined	do.	26,885	24,159	21,442	21,271	[2]16,406
Tellurium metal	kilograms	14,066	15,007	9,836	7,317	[2]4,078

See footnotes at end of table.

TABLE 4—Continued

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1984	1985	1986	1987[p]	1988[e]
METALS—Continued						
Tin, mine output, Sn content		3,314	3,807	4,817	5,263	[2]4,378
Tungsten, mine output, W content		699	771	742	205	[2]432
Zinc:						
Mine output, Zn content		465,890	523,434	597,576	612,477	[2]485,429
Metal		148,372	[r]162,725	155,811	144,169	[2]123,125
INDUSTRIAL MINERALS						
Barite		46,323	21,661	9,945	8,354	8,500
Boron materials, crude (borates)		[e]10,000	[e]10,000	22,557	22,710	15,000
Cement, hydraulic	thousand tons	1,869	1,947	2,207	2,584	2,500
Chalk[e]		470,000	470,000	470,000	470,000	470,000
Clays:						
Bentonite		12,971	2,017	33,080	18,700	20,000
Fire clay		5,601	4,305	[e]5,000	50	100
Kaolin		[e]1,000	210	6,328	233	200
Common clay		269,123	115,588	406,587	1,083,528	600,000
Diatomite		7,471	14,854	8,905	20,916	15,000
Feldspar		3,225	—	19,467	64,749	20,000
Gypsum, crude		66,722	28,640	171,347	228,845	150,000
Lime[e]		35,000	35,000	35,000	[r]12,500	13,000
Mica[e]		550	550	550	550	550
Nitrogen: N content of ammonia[e]		85,000	85,000	[r]100,000	[r]80,000	95,000
Phosphates, crude		12,694	12,216	5,167	60,713	60,000
Salt, all types		253,027	204,992	399,387	130,741	130,000
Stone, sand and gravel:						
Stone:						
Dolomite		4,565	1,635	[e]2,000	60	100
Flagstone		—	—	467,766	[e]400,000	300,000
Granite		—	—	—	64,296	60,000
Limestone	thousand tons	1,906	2,031	2,935	1,657	1,600
Marble		5,396	1,550	7,258	9,926	8,000
Onix		[r]294	—	143	577	500
Quartz and quartzite (crushed)		2,465	2,150	[e]2,200	848	1,000
Shell, marl		—	—	5,437	[e]5,000	4,000
Slate[e]		18,000	18,000	18,000	18,000	18,000
Travertine		[r]22,655	[r]550	4,082	6,524	5,000
Sand and Gravel:						
Construction	thousand tons	2,421	1,902	4,847	6,911	5,000
Silica sand	do.	53	2	99	76	75

See footnotes at end of table

TABLE 4—Continued

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1984	1985	1986	1987[p]	1988[e]
INDUSTRIAL MINERALS—Continued						
Sulfur:						
Elemental:						
Native[e]		100	100	100	100	100
Byproduct of metallurgy		64,256	64,145	66,300	[e]66,000	66,000
Sulfuric acid, gross weight		199,431	182,031	207,190	[e]200,000	200,000
Talc and related materials:						
Talc		510	500	1,754	1,447	1,500
Pyrophyllite		8,728	—	7,354	705	1,000
Total		**9,238**	**500**	**9,108**	**2,152**	**2,500**
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		5,329	5,949	5,439	5,877	5,500
Coal:						
Anthracite, run-of-mine[e]		84,000	92,750	90,000	90,000	90,000
Bituminous, run-of-mine		[r]42,429	[r]32,691	61,077	107,501	67,000
Total		**[r]126,429**	**[r]125,441**	**151,077**	**197,501**	**157,000**
Coke, all types[e]		10,000	10,000	10,000	10,000	10,000
Gas, natural:						
Gross	million cubic feet	45,484	47,256	50,012	49,279	48,001
Marketed	do.	[e]22,000	[e]22,000	22,124	17,418	[2]15,365
Natural gas liquids:						
Natural gasoline and other[5]	thousand 42-gallon barrels	190	249	240	335	[2]368
Propane	do.	49	81	69	29	[2]24
Butane	do.	6	6	6	9	[2]5
Total	**do.**	**245**	**336**	**315**	**373**	**[2]397**
Petroleum:						
Crude	do.	67,374	[r]68,620	65,262	59,730	[2]51,717
Refinery products:						
Gasoline, motor	do.	11,539	11,627	11,702	11,425	[2]11,694
Jet fuel	do.	2,654	2,377	2,551	2,260	[2]1,991
Kerosene	do.	6,220	6,353	6,940	6,464	[2]7,404
Distillate fuel oil	do.	12,020	12,389	10,577	10,444	[2]9,503
Residual fuel oil	do.	26,617	25,652	27,441	28,829	[2]27,306
Lubricants	do.	63	58	61	63	[2]54
Liquefied petroleum gas	do.	1,429	1,407	1,577	1,620	[2]1,649
Asphalt	do.	212	271	333	446	[2]1,009
Refinery fuel and losses	do.	386	537	1	2	[2]39
Other	do.	1,074	1,536	1,131	397	[2]252
Total	**do.**	**62,214**	**62,207**	**62,314**	**61,950**	**60,901**

[e] Estimated. [p] Preliminary. [r] Revised.

[1] Table includes data available through Aug. 1989. Where appropriate, data have been revised to conform with that reported in Anuario de la Mineria Peru, 1977–1985. Ministerio de Energia y Minas, Lima, 1986, 167 tables. Production figures for 1986–88 do not necessarily reflect recoverable metal content as do those for prior years.

[2] Reported figure.

[3] Output reported by Empresa Minera del Centro del Peru S.A.

[4] Excludes sponge iron production as follows, in tons: 1984–62,121; 1985–49,300 (revised); 1986–55,500 (revised); 1987–60,100; and 1988–51,000.

[5] Includes hexane.

exports up 5% in 1988 compared with that of the previous year. Earnings were held back by two nationwide strikes that paralyzed more than three-quarters of the mineral sector's labor force for almost 80 days between July and August and between October and December. Mineral production losses due to the strikes, which in turn helped to push up the prices of copper and zinc in London and New York during the second half of 1988, were estimated at $300 million. Imports in 1988 were down by 13.6%, and the trade deficit at yearend fell to approximately $60 million, compared with a $521 million deficit in 1987.

According to figures released by the Peruvian Central Reserve Bank for 1988, the export volume of all major metals, except iron ore, decreased as follows: Copper (-18%) to 287,000 tons, silver (-34%) to 9.1 million troy ounces, lead (-18%) to 121,000 tons, zinc (-11%) to 384,000 tons, and gold (-64%) to 764 troy ounces. Iron ore exports increased (18%) to 4.6 million tons. Despite this decrease in export volume, the value of all minerals exported rose 3% to about $1.2 billion in 1988 compared with that of 1987, because of increased metal prices during the year.

Exports of nonfuel minerals accounted for 45% of total exports. Copper alone represented 22.1% of the total, while lead, zinc, and silver accounted for 7.4%, 9.5%, and 2.2%, respectively. After 3 years of decreasing oil production, at yearend the country became a net importer when crude oil and petroleum products imports exceeded exports by $48 million for the first time. Crude oil and petroleum products exports accounted for 6% of the total value of exports.

Commodity Review

***Metals.*—Copper.**—In addition to the sizable decrease in mine output, refined copper production decreased 20% to about 179,500 tons compared with the 1987 output. Total copper exports during the year were valued at approximately $606,600 (including the value of silver contained in copper concentrates), 19% higher than the 1987 value, despite the 18% drop in volume exported.

SPCC, the country's largest copper producer, reported a total mine output of 193,648 tons, a decrease of 22% from the 1987 figure. The Cuajone Mine contributed 108,030 tons and the Toquepala Mine 85,618 tons. Output from both mines accounted for 65% of Peru's total copper production.

Serious labor problems during the year resulted in production declines. SPCC's blister copper production fell to 83,752 tons (99.2% Cu) containing 650,409 troy ounces of silver and 2,076 tons of molybdenum concentrate (92.7% MOS_2). Following the workers' decision to return to work, SPCC renewed its deliveries of blister copper to Minero Perú's Ilo refinery on December 19. Approximately 60% of SPCC's blister copper output is usually refined at Ilo under a toll agreement. SPCC was expecting to receive its first deliveries of copper cathodes from the Ilo refinery during the first week of January 1989. The controversy over the recovery of the $727 million investment made by SPCC to develop the Cuajone Mine was still unresolved by yearend. According to the contract, the date when the total investment would be recovered was to be established by a joint declaration of the Ministry of Energy and Mines and the Ministry of Finance. There were some disagreements between the Ministries as to the rate of exchange to be applied for the calculation of the amount of investment to be recovered, so SPCC decided to take its case to court.

Centromín, the state-owned mining company, reported copper production of 22,031 tons from its mines, a 49% drop relative to the previous year's figures reflecting the serious effect of the 87-day strike. One of the most affected mine units of Centromín was Cobriza, an underground, highly mechanized copper mine with a plant capacity of 10,000 tons per day of ore. Cobriza's ore production during the year declined 50% and continued operating at 50% of its installed capacity, mainly because of a severe shortage of spare parts for its mining equipment and terrorist attacks at La Oroya metallurgical complex.

Centromín nonetheless developed important projects which will enable the company to improve operations, subject to the availability of funds and normal working conditions. Centromín reached an agreement with the Canadian International Development Agency (CIDA), which was to provide $5 million for the purchase of mining equipment. Another project calls for the construction of an oxygen plant (300-ton-per-day capacity) for the La Oroya copper smelter requiring an investment of $28 million, 50% of which will be financed by the Andean Development Corp. The Inter-American Development Bank (IDB) was considering a $75 million loan to implement a project for massive equipment replacement in all of Centromín's mines, concentrators, smelters, refineries, railroads, workshops, and other support services. The $13.3 million expansion of the Cerro de Pasco Mine from 3,000 to 7,000 tons per day was underway.

Centromín approved and initiated a 4-year exploration program in areas surrounding its existing mines with an annual investment of $5 million. This program was originally designed and financed by the United Nations.

Metallurgical research and development programs to improve recovery, especially of silver, from the Cerro de Pasco Mine were underway with the assistance of the Japanese Metallic Mining Association.

Minero Perú continued operating its Cerro Verde copper mine, the Ilo copper refinery, the Cajamarquilla zinc refinery, the Bayóvar phosphate plant, and the San Antonio de Poto gold placer project. At Cerro Verde, Minero Perú planned to treat secondary copper sulfides by the hydrometalurgical-

flotation process with an average production of 60,000 tons per year of concentrates containing about 35% copper. Minero Perú has already issued a public international tender for an extimated $50 million turnkey contract. Bids were scheduled to be opened on February 13, 1989. With its current facilities, Cerro Verde produced 19,915 tons of refined copper cathodes from its electrowinning plant, a 19% drop compared with the previous year, and 15,000 tons of copper concentrates from its small flotation plant. Minero Perú installed a small 3-ton-per-day pilot plant to obtain aluminum sulfate crystals for sales to SODAPAR, the Arequipa water distribution company. Minero Perú planned to increase production gradually to 60 tons per day and was also carrying out studies for the production of magnesium sulfate, copper sulfate, and copper exychloride crystals. Minero Perú's Ilo copper refinery produced 128,269 tons of copper cathodes, 1.6 million troy ounces of silver, and 3.0 million ounces of gold. The project to increase the refining capacity of its Ilo plant from 150,000 tons per year to 175,000 tons per year was affected by the shortage of foreign currency required to import equipment; nonetheless, the company was expecting to complete installation of the 28 new electrolytic cells by mid-1989. Aside from Cerro Verde, Bayóvar, and San Antonio de Potos, the other deposits assigned to Minero Peru (Antamina, Michiquillay, Quellaveco, Berenguela, the Bambas, Canariaco, etc.) remained without developments during the year.

Tintaya, the most recently opened state-owned copper and silver mine and the second largest copper producer in Peru, contributed with 33,990 tons of the fine copper and 486,119 troy ounces of silver, a 40% and 41% decrease in output, respectively, compared with output of 1987. During the year, Tintaya shipped about 126,000 tons of copper concentrates averaging 31.3% copper worth $78.4 million.

Tintaya, owned 45% by Minero Perú, 45% by Centromín, and 10% by Inversiones COFIDE, continued its operations at Espinar, in the Cuzco Department. Although the company faced a series of labor problems and severe operating restrictions, because the Central Reserve Bank had limited the availability of foreign currency to import equipment and spare parts, it was able to maintain the high quality of its product and meet its sales commitments. Tintaya also continued studying the feasibility of developing the nearby Coroccohuayco copper deposit, which has proven reserves of over 14 million tons assaying 2.6% copper. This project, requiring an investment of about $43 million, was being reviewed as a joint venture by the China International Trust Investment Corp. (CITIC) and China's National Nonferrous Metals Industry Corp. (CNNC). Another possible joint-venture project with China was related to the treatment of 8 million tons of 2.7% copper oxide ore from the overburden removed during the preparation of the open pit mine, which exposed the copper sulfides ore. The latter was treated in its 8,000-ton-per-day flotation plant. The proposed new project would produce about 16,000 tons of copper cathodes per year from an electrowinning process.

The medium-sized mining sector's most important copper producers in 1988 were again Minera Pativilca S.A. and Minera Condestable S.A. The medium-sized mining sector was comprised of about 33 mining companies, 31 of which were Peruvian-owned and 2 of which were joint ventures with foreign companies, that produced 7.4% of the total copper output, 57.3% of the lead, 63.3% of the zinc, and 74.1% of the silver in Peru. The Santa Luisa S.A. copper, lead, silver, and zinc producer, is 100% owned by Mitsui Mining and Smelting Co. and Mitsui and Co. Ltd. of Japan. The Corporación Minera NorPerú S.A. operates the Quiruvilca polymetallic deposit 80% owned by ASARCO Incorporated of the United States.

Gold.—Despite increased output from the alluvial gold placer deposits, the total production of gold as reported by the Ministry of Energy and Mines increased slightly compared with that of the previous year. Placer gold production was based on purchases by the Banco Minero. The difficulty of making a reasonable estimate of the gold produced continued because of the thousands of gold panners operating along river banks throughout the country.

Gold purchases deteriorated since September when the 15% premium paid by Banco Minero was reduced to 5%. At yearend, Banco Minero was still paying a 5% premium over the world gold price payable in local currency at the bank exchange rate.

PERU'S GOLD PRODUCTION

(Troy ounces)

	1986[r]	1987[r]	1988[e]
In ores and concentrates	130,050	109,248	100,000
Refined	34,074	64,977	77,000
Placer production	70,249	88,961	92,000
Total	**284,373**	**263,186**	**269,000**

[e]Estimated. [r]Revised.

The southeastern region of Peru comprising the Madre de Dios, Puno, and Cuzco Departments continued to be the largest source of alluvial gold. Compañía Aurífera Río Inambari S.A. (CARISA), continued to be the only company operating a gold dredge on the Madre de Dios River with a monthly average output of 7,000 troy ounces, which was sold entirely to Banco Minero. In 1988, officials from the International Finance Corp. (IFC) returned from an inspection and review of the expansion project of the gold dredge operation. It was in the process of obtaining from its Board of Directors approval for a $2.7 million loan to implement the second stage of the project, which included a second dredge estimated to cost around $4 million, additional camp facilities,

and other infrastructure. The company expected to obtain a decision from IFC by the middle of 1989.

Compañía Aurífera El Sol S.A. and Aurífera Los Incas S.A. entered into a joint-venture agreement to develop the gold placer concession owned by Aurífera El Sol in the Madre de Dios eastern jungle. Texas Gulf of the United States maintained its 10% interest in the venture.

Minero Perú announced by yearend that it had signed a $22 million contract with the Swiss-based company Alluvial Dredge for the engineering and supervising of the construction of a dredge to treat 3.5 million cubic meters per year of gold-bearing gravel in the Pampa Blanca area of San Antonio de Poto. The project was expected to start production at the level of 35,400 troy ounces of gold per year by 1990. Minero Perú also announced that the San Jacinto dredge, which was to be operated by the Natomas Co. of the United States until 1972, was being repaired at a cost of $7 million and was to be ready to treat up to 1.7 million cubic meters per year of material containing 0.23 gram of gold per ton at the Arequipa Pampa zone by 1990.

Cía. de Minas Orcopampa S.A., a subsidiary of the Cía. Minera Buenaventura S.A. with its Polymetallic Castilla Mine in Arequipa, continued as the main private producer with a total output of 32,500 troy ounces of gold contained in its concentrates.

Asesoría Contable Minera S.A. (ACOMMSA), operator of the Ocona, Santa Clarita, Explatoro, and Molino de Oro lode gold mines, in the Department of Arequipa, was the second largest producer of refined gold in the medium and small sector. ACOMMSA produced 22,500 troy ounces of fine gold, a 10% drop with respect to 1987. All ACOMMSA's production was sold to the Banco Minero. Compañía Minera Poderosa S.A. continued operating its Poderosa lode gold mine in the Province of Pataz, Department of La Libertad, with positive results from its exploratory efforts. Reserves were estimated at 254,000 tons of ore grading an average of 13.7 grams per ton. Poderosa Mine was the largest producer of refined gold in the medium mining sector with an output of 25,600 troy ounces, a 37% increase relative to that of 1987.

Lead, Zinc, and Silver.—Production of lead, zinc, and silver was seriously affected by labor problems and energy supply disruptions as a result of terrorist attacks. In line with decreased output of concentrates, production of refined lead, zinc, and silver declined by 25%, 15%, and 23%, respectively, compared with that of 1987. Centromín continued to be one of the most important lead, zinc, and silver producers in the country and contributed 43%, 38%, and 22% of lead, zinc, and silver, respectively, of the country's total output. It operated seven mines and a smelting and refining complex at La Oroya.

Centromín's output of lead, zinc, and silver decreased by 24%, 28%, and 33%, respectively, below that of the previous year. Centromín's most important producers of lead, zinc, and silver were lead from the Cerro de Pasco, Casapalca, and Yauricocha Mines; zinc from the Cerro de Pasco, Mahr Tunnel, and Casapalca Mines; and silver from the Cerro de Pasco, Casapalca and Morococha Mines.

In the private sector, the most important producers of lead, zinc, and silver were lead from Cía. Minera Milpo S.A., Cía. Minera Atacocha S.A., and Cía. Minera Santa Luisa S.A.; zinc from Cía. Minera San Ignacio de Morococha S.A., Perubar S.A., and Cía. Minera Santa Luisa S.A.; and silver from Cía. de Minas Orcopampa S.A., Cía. de Minas Buenaventura S.A., Minas de Arcata S.A., Corporación Minera NorPerú S.A., Cía. Minera Caylloma S.A., Cía. Minera Huarón S.A., Southern Peru Copper Corp., sucursal del Perú, and Cía. Minera Milpo S.A.

Exports during 1988 amounted to 44,943 tons of refined lead and 75,902 tons of lead concentrates (containing silver), valued at $202 million; 57,485 tons of refined zinc and 326,191 tons of zinc concentrates, valued at $261 million; and 9.07 million troy ounces of refined silver, valued at $60 million. The average price for silver in 1988 was $6.53 per troy ounce compared with $7.02 per troy ounce in 1987.

With assistance from the IDB, Centromín was expecting to finance its $200 million investment plan aimed at restoring its productive capacity, which has been deteriorating steadily since 1985. The plan includes 42 different projects, most of them aimed at modernizing and expanding current operations. Centromín was also hoping to benefit from part of a donation of $15 million in mining equipment made to the country by CIDA.

Cía. de Minas Orcopampa S.A., a subsidiary of Cía. de Minas Buenaventura S.A., operated a polymetallic deposit in the Department of Arequipa, containing mainly gold and silver. In 1988, Orcopampa outranked its parent company, traditionally the largest private silver producer. Despite labor problems, output of concentrates increased slightly to 12,719 tons containing 339 troy ounces of silver per ton, 2.6 troy ounces of gold per ton, and 3.5% copper valued at $34.3 million compared with $38.6 million in 1987. Proven and probable ore reserves at yearend were 2.3 million tons of ore with an average grade of 0.14 troy ounce of gold and 14.7 troy ounces of silver per ton. Work on the Orcopampa cyanide processing plant was completed in 1988. Cía. de Minas Buenaventura S..A., the second largest silver producer in the medium sector, continued operating its Julcani and Uchucchacua deposits in Huancavelica near Huancayo. Operations during the year were seriously affected by labor strikes, the longest ever in the company's history. The Julcani Mine produced 4,177 tons of lead concentrates assaying an average of 300 troy ounces of silver per ton, 10.6% lead, 13.8% copper, and some gold and bismuth values.

Ore reserves by yearend were estimated at 384,000 tons of ore grading 15.8 troy ounces of silver per ton, 0.69% copper, and 0.85% lead.

Production at the Uchucchacua Mine totaled 12,900 tons of leached concentrates averaging 240 troy ounces of silver per ton, 13.2% lead, and 2,607 tons of zinc concentrates averaging 45.9% zinc and 13.3 troy ounces of silver per ton. Reserves by yearend were estimated at 1.8 million tons of ore grading 13.2 troy ounces of silver per ton, 1.0% lead, and 1.5% zinc. The total value of production from Julcani and Uchucchacua Mines was $26.2 million compared with $33.3 million in 1987. Silver represented 90.9% of Cía. Buenaventura's mineral sales, followed by gold with 3.4%, lead 3.3%, copper 1.9%, and zinc 0.5%.

Cía. de Minas Arcata, S.A. also experienced the negative effects of labor problems during the year. Ore production dropped by 15% to 265,000 tons in 1988. Silver production decreased 6.3% to 3.6 million troy ounces while gold decreased from 11,124 troy ounces to 10,610 troy ounces. Arcata's sales in 1988 reached 11,264 tons of ore concentrate containing 3.6 million troy ounces of silver valued at $23 million. Of this tonnage, 10,443 tons was exported, and 821 tons was delivered to La Oroya smelter of Centromín.

Output by the Cía. Minera Caylloma S.A. declined from 2.5 million troy ounces of silver and 6,719 troy ounces of gold in 1987 to 2.1 million troy ounces of silver and 6,430 troy ounces of gold in 1988. Reserves by yearend increased to 1 million tons of ore averaging 13.7 troy ounces of silver per ton. Sales during the year amounted to 1.7 million troy ounces of silver compared with 2.2 million troy ounces of silver in 1987.

Tin.—MINSUR S.A., Peru's only tin producer, continued operating its San Rafael and Santa Bárbara Mines in Melgar Province, Puno Department. The San Rafael Mine was the only producer of tin concentrate in the country. MINSUR's production of tin concentrate dropped 17% to 4,378 tons in 1988 and were shipped to Tex Tin Corp. in the United States, and to RTZ Corp. and PLC's Capper Pass smelter, both in the United Kingdom. Ore reserves at San Rafael Mine amounted to 2.3 million tons of tin at yearend. MINSUR has deferred a $9 million investment project to build a tin refinery in Pisco, 230 kilometers south of Lima. According to local sources, the company has decided to postpone major investments until after the 1990 presidential elections. COFIDE S.A., the state-owned financing development corporation, was to cancel a $5 million loan approved in February because FUNSUR S.A., the MINSUR subsidiary setup for the project, had not requested disbursements for more than 6 months. MINSUR, part of the BRESCIA Group, first decided to postpone the construction when the Government boosted interest rates as part of the September 1987 economic policy adjustment. The project had been scheduled to begin at the end of 1988. At the same time, the deteriorating economic situation in Peru led the IFC of the World Bank to freeze a $1 million loan to the project. The project plan was to refine all MINSUR's tin concentrate production to obtain around 5,300 tons per year. Domestic refining of all the tin concentrates would provide Peru with added value estimated at $10 million per year. The total estimated investment for this project was about $13 million, which included $5 million in foreign currency and the balance in local currency (Intis). The plant would have an annual capacity for treating 12,000 to 15,000 tons of tin concentrates yielding between 5,000 and 6,250 tons of tin ingots with a purity of 99.85%.

Tungsten.—Cía. Minera Regina S.A. continued as the country's sole producer of tungsten concentrate, operating its Palca XI deposit about 140 kilometers north of Juliaca in Puno Department. Plant operations, which were stopped at the end of August 1987 to implement design changes to improve recovery and capacity, were reopened in mid-January, and by December recovery had reached 65.0%. During 1988, Minera Regina processed 60,913 tons of tungsten ore, producing 834 tons of concentrates containing 538 tons of WO_3, an increase of 94% compared with that of 1987. The company was planning to increase production by 110% in 1989. Three types of concentrates were produced: ferberite (an iron tungsten, $FeWO_4$), and, for the first time, scheelite (calcium tungsten, $CaWO_4$), and a mixed concentrate. Sales of $2.5 million were made to Walter Metals Ltd. and two United States companies (General Electric and Strategic Minerals, which received 90% of the exports). The Federal Republic of Germany and Japan received 5% each. By yearend, proven and probable ore reserves increased to 1.1 million tons of tungsten ore grading 1.83% WO_3. These reserves assure feed for the concentration plant at the projected capacity of 9,000 tons of ore per month for 10 years.

***Industrial Minerals.*—Phosphate Rock.**—Minero Perú's plans to develop Area 1 of the Bayóvar phosphate deposit in Sechura Province in the northern Department of Piura became uncertain, following the decision made by Fletcher Challenge Ltd. of New Zealand to concentrate large new investments in Chile. However, Minero Perú officials stated that they were still waiting for a final reply from the New Zealand company on a $7 million loan request to expand the Bayovár concentration plant. The previous plans to establish a joint mining company and build a 400,000-ton-per-year treatment plant were apparently abandoned and replaced by the loan request, which would allow Minero Perú to expand the current plant's capacity from 90,000 tons per year to 200,000 tons per year. The arrangement under discussion included the repayment of

the loan with 50,000 tons per year of phosphate concentrates over a period of 5 years and would grant Fletcher the right to an additional 50,000 tons per year of concentrates.

The Government has approved the basis for a public international tender for a turnkey contract, which required financing for the exploitation, transportation, and marketing of the Bayóvar phosphate deposit in Area 2, also located in the Sechura desert in the Department of Piura. The estimated $168 million project includes the installation of a 1.5-million-ton-per-year beneficiation plant, port facilities for ships of up to 50,000 tons, a 15-megawatt powerplant, freshwater supply system, mining camp, and road reconstruction. Empresa Promotora Bayóvar (Pro Bayóvar), the state-owned company responsible for the project, was very optimistic with respect to possible bidders from the Soviet Union, the United States, and Mexico. A $7.5 million World Bank technical assistance loan to help finance engineering for the project could result in the establishment of a major new phosphate fertilizer company. Pro Bayóvar currently operates under the control of the Government of the Grau Region. Meanwhile, Minero Perú continued with the exploitation of the Bayóvar deposit Area 1, a zone not included in Pro Bayóvar's mineral rights.

***Mineral Fuels.*—Coal.**—The first industrial coal conversion plant in Peru was under construction by Lar Carbón S.A., a subsidiary of Cementos Lima S.A. and Cemento Andino S.A., the main cement manufacturers of the country in association with Rheinbraun Verkauf of the Federal Republic of Germany. The coal-fired plant is located at Atacongo near Lima and was expected to start burning 200,000 tons of bituminous coal per year by mid-1989, instead of the 900,000 barrels of oil used in 1988. The coal conversion plant will have a design treatment capacity of 300,000 tons of coal per year at a cost of $16 million. The coal-fired plant was expected to save $4 million annually in oil imports.

The Government has authorized the importation of 200,000 tons of bituminous coal during the first year of plant operations from producers in the United States, Colombia, Australia, and Chile until domestic coal production can meet demand. Since most of Perú's known coal deposits contain anthracite coal, Lar Carbón was conducting research on the utilization of a combination of bituminous and anthracite coals as fuel with the anthracite component ranging 20% to 35%. In addition, Lar Carbón was planning to initiate exploration for bituminous coal in the jungle.

Cementos Norte Pacasmayo, the second largest cement manufacturer in the country, was also looking into coal fuel utilization, but was considering the possibility of using a mix of oil and anthracite coal, a type of coal that is abundant in the northern part of Peru, where the plant is located. The company signed a contract with Fuller International Inc. of the United States to study its $8 million project, which would allow the plant to burn either oil or a coal-oil mix.

The Government coal company, Procarbón, continued working on some of its projects, but with very limited resources and support from the central Government. The small anthracite briquetting plant installed in Huaraz Department with the aid of the U.S. Agency for International Development continued operating during the year, and the market for this inexpensive domestic fuel started expanding around the marketing area of the pilot plant. Minero Perú continued developing the Callacuyán anthracite mine, located within the Alto Chicama coalfield, and the company was expected to start supplying state-owned Empresa Siderúrgica del Perú S.A. (Siderperú) steel plant with coal for its Chimbote unit during 1989.

With the technical cooperation of the Republic of Korea, and the support of COFIDE, Siderperú, Minero Perú, Petroperú, and the Ministry of Energy and Mines, Procarbón installed an 80-ton-per-day coal plant near Chimbote (Ancash Department) on the coast north of Lima to produce coal briquets, which will initially be used instead of kerosene by the low income families in the area for domestic cooking. It was estimated that some 60,000 families will benefit from this fuel substitution considering that coal briquets are cheaper than kerosene.

Petroleum and Natural Gas.—Peruvian crude oil production averaged around 141,700 barrels per day, which represents a decrease of 13% relative to the 1987 production figure, owing mainly to lower output by Occidental Petroleum. Occidental reduced output while waiting for payment on accumulated debt. Petroperú, the state-owned oil company, also fell behind on payments to its offshore subsidiary Petromar S.A. with the consequence of lower output.

After 3 years of decreasing oil production, the country became a net importer by yearend when the value crude oil and petroleum products imports exceeded exports by $48 million. Petroperú continued to experience severe difficulties because of the Government's decision to maintain subsidies on the selling price of fuels in the domestic market, which, according to its officials, represented a daily loss in the order of $3 million. The company also faced serious problems due to Government restrictions regarding foreign currency availability to purchase spare parts and equipment. This affected the company's flexibility in its operations. Petroperú's operating deficit during 1988 was estimated at $396 million, 40% higher than that reported in 1987.

Petroperú operated four subsidiaries: Petroleros del Mar S.A. (Petromar), Petrolera Transoceánica S.A. (Transo), Servicios Petroperú (Serpetro), and Cía. Peruana de Gas S.A. Petromar operated Peru's only offshore oilfields (Blocks

Z1-A, Z2-A, covering 814,000 hectares) near Talara on the northern coast. Transo was in charge of all maritime and coastal transportation of crude and petroleum products, using its own and chartered ships. Serpetro provided technical assistance to the petroleum industry in general and sought new investors under exploration and production contracts. Peruana de Gas, 85% owned by Petroperú, competed in the domestic marketing of liquid petroleum gas and electric and gas appliances.

For the seventh consecutive year, crude oil reserves continued to declined to 457 million barrels by yearend; natural gas reserves, on the other hand, increased significantly with Shell Del Perú S.A.'s discovery in Bock 42 in the southern jungle region. In the Aguaytia Field in the central jungle region, scheduled to be developed in the near future, Petroperú expected to recover a total of 255 billion cubic feet of gas and 21 million barrels of condensate. In addition, Perú has proven gas reserves in the coastal and offshore fields in the northwest amounting to 348 billion cubic feet by yearend.

Occidental Petroleum decided to increase its exploration budget in the jungle, following the settlement reached with the Government on an outstanding dispute over fees, taxes, and exchange rates to be applied to the company's financial operations in Peru. By yearend, Government officials announced a large oil find in Occidental's first wildcat, La Colpa IX, in its central jungle Block 36 concession. A spokeman for Occidental in Lima stated that the La Colpa find was a very positive indication of the presence of oil in the Ucayali basin, where Royal Dutch/Shell and Mobil Oil Corp. had previously detected the existence of natural gas. Following a heated dispute over the right of Royal Dutch/Shell to develop the Camisea Gasfields discovered by the company in the central southern jungle, with estimated reserves of 10 trillion cubic feet of natural gas and around 600 million barrels of condensate, the Government decided to call for international bids rejecting the legal complaint made by Shell to regain control of Blocks 38 and 42, where $175 million of exploration work led to the discovery of the gas reservoir. While Shell maintained that negotiation for the $1.3 billion natural gas development project had not terminated, Petroperú argued that the Dutch company had failed to start developing the gas find. Exxon Corp. of Houston was unable to reach agreement with Petroperú over its payment for the Belco Petroleum assets expropriated by Peru in 1985. The Government made an offer of $147 million, provided the money was invested in Peru. The company was reported to be ready to accept the conditions but disputed the amount, which they claimed should be in the order of $400 million.

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[1] Prepared by Orlando Martino, physical scientist, Division of International Minerals.

[2] Prepared by Ivette E. Torres, physical scientist, Division of International Minerals.

[3] U.S. Embassy, La Paz, Bolivia. Industrial Outlook Report—Minerals. State Dept. Airgram A-12, July 6, 1989.

[4] ——. Economic Trends Report. State Dept. Airgram A-09, May 18, 1989.

[5] Where necessary, values have been converted from Bolivianos ($b) to U.S. dollars at the rate of $b2.4 = US$1.00.

[6] Where necessary, values have been converted from Deutsche Mark (DM) to U.S. dollars at the rate of DM1.78 = US$1.00.

[7] U.S. Embassy, La Paz, Bolivia. Industrial Outlook Report for Hydrocarbons and Natural Gas. State Dept. Airgram A-10, June 13, 1989.

[8] Prepared by Alfredo C. Gurmendi, physical scientist, Division of International Minerals.

[9] Where necessary, values have been converted from Ecuadorian Sucres (S/.) to U.S. dollars at the rate of S/459 = US$1.00.

[10] Prepared by Pablo Velasco, physical scientist, Division of International Minerals.

[11] Where necessary, values have been converted from Peruvian intis (I/) to U.S. dollars at the financial or banking rate of I/312.50 = US$1.00.